Session 3.4: Grading and packing

Key learning points

- ❒ Grading
- ❒ Packhouse management
- ❒ Packaging

Main objectives of the session

By the end of the session participants will be better able to:

- ❒ Understand the conditions under which the grading of produce is justified
- ❒ Understand the alternative grading techniques
- ❒ Define EU export specifications and legislation for grades, packages and labels
- ❒ Evaluate and design appropriate packages for fresh fruit and vegetables
- ❒ Understand how good packaging can significantly reduce mechanical damage
- ❒ Evaluate the cost effectiveness of packing fresh fruit and vegetables
- ❒ Manage a packing and grading facility

3.4.1 Grading

Produce brought to many markets often has variable characteristics and may be contaminated with dust, stones or other foreign matter. Sometimes it may be delivered immature or contain shrivelled, damaged and rotten material. Delivering such produce generally results in lower prices. Grading aims at ensuring a uniformity of the produce supplied to the buyer in areas such as colour size, the general appearance and taste. Product may be sorted according to all or any of these characteristics and defined in product specific grading specifications.

Provided the market wants graded produce and is prepared to pay for it then selection and grading are justified. The additional prices must cover the additional costs. Buyers normally specify their own grading standards, particularly in the export market where international standards may be enforced. Grading helps to develop greater confidence between buyers and growers, enables continuous improvement in activities that add value and allows old and obsolete varieties to be replaced and improved. Grading also removes infected and low quality produce, reduces storage losses, helps to increase sales possibilities and establishes a better relationship between the quality of the product and the price.

Grading can be by hand in the field or using machinery at a packhouse comprising of either

- A simple line where the product moves in front of qualified workers who pick the produce manually according to their characteristics, or
- Mechanised lines where sorting is made by machines according to the size or colour of the product.

These facilities are normally incorporated as part of a packing and grading house.

3.4.2 Packhouse management

Packhouses receive deliveries of fresh fruits and vegetables direct from producers, assembly markets or collection points and clean, grade and pack it in a form agreed with individual retailers or export agents. Once packed the produce is prepared in standardised bulk loads available for loading and unloading in palletised form and for onward delivery to wholesalers, distribution points or retailers direct. The numbers of packhouses in Europe have increased considerably in recent years, largely in response to the growth and expansion of retail supermarkets, the export trade and an increasing demand from consumers for packed and graded produce.

Some packhouses have very simple equipment for example packing onions into net bags that are sealed by hand. Others have very sophisticated technologies that are fully computerised and include laser grading on the basis of colour or texture. Sometimes individual producers own packhouses but more often they are owned by a joint group of growers or by commercial traders. Although packhouses often do have their own cooling facility for produce more often the packing operation is organised to assist in the rapid packing and transfer of product to the consumer. Packhouse managers are in daily

contact with buyers and will often prepare packs with the labels of individual retailers, barcodes and daily prices included on the pack.
Within a packhouse, the physical arrangement of equipment and workstations that handle the produce basically operates like a factory assembly line. An important consideration for the packhouses is its nearness to the production fields and roads, primarily because fresh produce is very sensitive to transportation and delays. A delay of 12 hours or more can cause a high level of produce damage. Horticultural production is seasonal. For this reason, the packhouses must also be of seasonal but designed to maximise packing of a range of products and so reduce fixed and operational costs.

As the volume of produce delivered to a packhouse is usually larger than the functionality of the unit, part of it will need to be stored for a small period of time. Additional storage might also take place if the condition of the market does not favour the immediate sale of the product. For this reason strategic planning of a packing house requires cooling plants to be included as part of their design in order to preserve delivered and stored product and pre-cool shipments before consignment. Pre-cooling equipment and procedures therefore also need to be incorporated into the packhouse design and packed produce should pass quickly and efficiently from the packing line to the pre-cooling area.

Special attention when managing a cold storage system will need to be given to condensation and humidity control, temperature control, sanitation, maintenance, container design and positioning and the storage compatibility of different commodities.

Pack houses need sufficient space to allow for easy access by transport vehicles as well as for loading and unloading of produce. During the design consideration also needs to be made of possible future enlargement As a general guide the total size of the plot on which the pack house is located should be five times the surface of the packing house building.

Knowing what crops are to be grown and what the production volume there will be during the season, will determine what equipment will be needed and how big the building and cold storage should be. To keep the building cool, good ventilation and fans will be needed. The produce should always move in one direction, with no crossovers of the product from each step in the packing operation. There should be one door for receiving produce from the field, and one door for shipping packed produce out.

Arrangements must be made for a good water source and adequate utilities. Water used to wash the produce must be potable (safe to drink). Floors should be sloped to 15 cms wide drains that are 15-20 cms deep.

Special attention will need to be given to the electrical requirements of the packhouse and sufficient to cover automated washing and sizing equipment, pre-cooling facilities and cold storage units.

The disposal of both liquid and solid waste is an important consideration in designing and setting up a packhouse. Floor drains will be needed in the facility to carry wastewater to a separate septic tank and the solid waste produce spread on fallow fields or sold as animal feed.

The design of a receiving area and packing line that fits individual needs is necessary. The receiving area will need to be elevated so that produce can be easily unloaded off the trucks or wagons carrying it from the field. The height of the receiving area will depend on the vehicles and unloading and loading equipment used such as pallet jacks, and forklifts.

There are two factors to consider when deciding on facility lighting, safety and quality. Light quality for the packing line includes the type of light, placement of light, intensity of light and related environmental factors. With grading and sorting produce, it is desirable to have lighting, which shows every bruise, blemish and mark on the produce.

There are other areas of the packhouse that will also need to be carefully including the container assembly area, restrooms, personal washing facilities, offices, workshops and laboratories.

Delivery of produce to a pack house is usually by truck transporting produce in pallets, plastic or wooden containers. The appropriate container for this purpose should be one that protects the product during transport, facilitates the unloading and allows for channelling the produce to the production line with as little injury as possible.

Transfer of produce to the production line, or to a temporary cooling and storage chamber, can be undertaken either manually (when the produce is carried in small plastic or wooden boxes) or mechanically with a hydraulic diverter. Initial transfer of product on the line will either be through a hydro-handling system, where the produce is diverted into a water tank, or with a conventional system where dry product is supplied. It is important to reduce produce injury as far as possible. Reducing mechanical injury will involve minimising drops and rolls at transfer points on the packing line. To achieve this, packing lines will need to be designed to be straight and have minimal changes in height between each component. Installation of suspended curtains over conveyors at sorting tables will reduce impact forces by up to 50%.

The initial area of grading and packing will include a system for cleaning and washing produce. Pathogens that are present on freshly harvested fruits and vegetables will accumulate in the water handling systems such as dump tanks and flumes or hydrocoolers where the water is re-circulated. Even healthy looking products can harbour large populations of pathogens, particularly during warm, rainy weather. Subsequently when fruits and vegetables are immersed in water containing pathogens they can become infected and decay during shipping and handling. Adding an approved sanitiser to the water helps prevent the accumulation of pathogens to the water and eliminates these problems. This will require maintaining 100 to 150 parts per million of chlorine and a PH in the range of 6.8 to 7.2 for all re-circulated water, at all time during use.

This recommended level will kill pathogens that cause produce decay. The addition of an approved sanitiser to the water, such as sodium hypochlorite, calcium hypochlorite, or liquid chlorine will also help to prevent the accumulation of pathogens. The effectiveness of chlorinated water as a sanitiser is greatly affected by the PH of the solution. All re-circulated water should be changed on a daily basis or more frequently if the water becomes extremely dirty due to the build-up of organic matter.

For some products, such as peaches, additional brushing will also take place. This helps in the removal of dirt and pathogens from the surface of the product and improves its appearance. Additional chemical treatments can be added during the process, including waxing to prevent moulds and physiological disorders during storage. These waxes include incorporation in the wax of:

- Mould inhibitors
- Growth inhibitors
- Plastic substances
- Antioxidants

A drying area will be needed following produce washing. Before being packed into containers, produce may be dried on sponges in a conveyor system, in an airflow or on screen tables. Some grading can be initially undertaken in the receiving area or in the field, especially if the produce is diseased, low grade or deformed. However most will take place on a large table where produce can be spread out for inspection, a rotating table or conveyor belt with a sizer. Sizing is an important part of packing a crop correctly. A buyer wanting a container with uniformly sized fruits and vegetables may also want them labelled appropriately and according to EU, national and the buyers own specifications.

Size may be designated as the number of produce that will fit into a standardised package but for others by size (length or diameter). The number of produce in a pack will usually correspond to a standard size range for specific fruit or vegetables. Containers will also have minimum weight ranges.

Once packed an area is required for placing packed produce into shipping, holding or marketing containers. Container filling is a critical operation and must be carefully monitored. Produce can be crushed during closure of an overfilled container and punctured during stapling. Under-filling of a container can also result in severe mechanical injury due to jostling during shipping and handling.

After produce has been packed into shipping containers the container will need to be labelled to describe with what it is i.e. the size, number or net weight, grade, the growers name and address, the date packed and a tracking code that incorporates the harvest date, bin number, packing time, packer number, inspector number and other product-specific information.

Once product is ready for shipment, it can be manually or mechanically loaded onto trucks for carrying to the market. If the product is packed and palletised, forklifts will be used for easier and safer loading.

In summary the general guidelines for the good operation of packing and grading houses are to:

- Ensure that sufficient space is available for sorting and packing operations
- Efficiently control the flow of product on the production line according to produce quality and other characteristics

- Ensure proper quality control procedures are in place and that the product can be observed throughout the process
- Avoid bruising and injuring of produce and cover hard spots on the production line with absorbing materials such as sponge
- Properly brief, train and supervise staff and ensure proper working conditions

3.4.3 Packaging

The two main functions of packaging are to help prevent mechanical damage and enhance the attractiveness of the produce. In addition to serving as a uniform measure of quantity, a properly designed container must protect the product during handling while allowing sufficient ventilation during cooling and storage. Often, containers are selected on the basis of cost shipping and storage. The container must be constructed of material with sufficient strength so that the package, rather than the product, bears the weight of the stacked pallet. Furthermore, individual or consumer packages should be designed in a way that facilitates the purchase of the product by displaying its characteristics while its size is appropriate for the end user.

Considerations when selecting packaging, basically these relate to:

- The need for containment appropriate to the logistics of distribution
- Protection of the produce to ensure that it arrives at the point of sale in the best possible condition
- Presenting the produce in a preferred style
- Environmental impacts relating to the handling of the used packaging

In relation to maintaining the quality of the product the main functions of a produce container are:

- To prevent and reduce injury to the product during transport and handling
- To provide ventilation to hasten cooling and escape of heat caused by respiration
- To reduce water loss from the product

Packaging presentation and brand names also will add value to produce but only in markets where consumers appreciate aesthetics and image. Possible containers include boxes, cartons, crates, bags, sacks and, plastic containers used for the transport of produce in all stages, but more importantly to the marketplace. Containers may be made of wood, styrofoam, or plastic, but corrugated fibreboard is the most popular rigid container. Each material has advantages and disadvantages. Stacking strength, length of storage, storage treatment, pre-cooling method and the cost will influence the choice of material. If the container has contact with water or ice, it will need to be made of water-resistant material. Fibreboard containers are often waxed to give them water resistance. Non-rigid containers such as bags and sacks are made of cotton, plastic mesh or ventilated plastic film. But although these will contain the produce they will give no structural support.

Container sizes and types have the disadvantage of making handling and transporting crops to markets difficult as often they do not fit well together on pallets in storage, or in trucks. Today most packages are standardised and this ensures that all producers and traders know what is being bought or sold. Different standards are in place for different types of produce. Standardisation is particularly important for export marketing.

Ventilation is critical for efficient removal of field heat during cooling and for maintenance of the product temperature during handling and storage. Containers need to be designed with vent holes large enough to effectively lower and maintain produce temperature for storage. If the produce is pre-cooled by room cooling or forced-air cooling, the cold room air has to be forced through the containers to remove field heat and to ensure the longest shelf life, the produce has to be pre-cooled as quickly as possible. Vents allow cold air to be forced more quickly through the containers and produce. Vents also allow the heat built up by respiration to escape. Produce exposed to high temperatures in unvented containers will usually have a shorter shelf life. A well-made container has uniform venting, so when it is stacked the vents will match other containers. As a general guide 5% of the container sides and/or ends will need to be vented.

Mechanical damage to produce can be significantly reduced through careful use of appropriate packaging. *Compression bruises* can be restricted by using containers that are strong enough to withstand multiple stacking. The packaging materials need to be particularly strong at the vertical corners. The packaging should also be shallow enough to prevent the bottom layers of produce being damaged by the weight or produce above. Cartons must not be overfilled. Damage is caused by the full weight of the pile of produce pushing down on the top layer of fruit or vegetables, causing the weight to be transmitted to the lower layers.

Impact damage and bruising can be the result of shocks in transport or dropping. This may occur either because each package is small enough to be thrown or too big to be easily handled. *Vibration damage* generally occurs during transport: vibration being transmitted through the produce. This kind of damage can be significantly reduced by achieving a balance between preventing the produce from moving within the packaging and forcing the produce together. Fruits are prevented from rubbing against one another by the use of cellular trays, individual wraps or cushioning pads. Wrapping fruits individually in tissue-type paper is a common practice and reduces vibrational and impact bruising from other fruit in the container. An example is paper or straw used to separate layers of apples. Alternately the box is gently shaken to settle the produce and then the space created is filled. The largest packaging size should not exceed 50 kg as this is the maximum weight that can be easily handled. Below that the size specification will depend on the customers requirements – be they the retailers or consumers. Furthermore it is possible to apply post-harvest fungicides and other protecting chemicals on the individual wrapping material and this will extend shelf life.

Wrapping will also hold product in the pack and the stack on the pallet. Unitised pallets can be wrapped with plastic film or mesh. Palletisation or unitised handling (stacking containers on standard size pallets) is used to reduce the number of times an individual container is handled, and the damage to the contents. Standard container sizes have been developed that fit interchangeably on the size of the pallet. Palletisation helps to promote efficiency in the distribution system.

Produce packaging materials can be conveniently divided into six classes:

Locally available materials, for example baskets woven from willow or cartons made from thin strips of wood. Typical problems associated with these materials are:

- Poor rigidity and design, which prevents multiple stacking
- Sharp edges, which can cause bruising or pierce produce
- Inefficient usage of transport space, which increases costs

There are, however, a number of advantages with using locally available materials. Material costs are low. Both jobs and incomes are created for local businesses that make the packaging. Local sources of packaging also make it easier to ensure its timely arrival. The benefits are such that in the first instance the grower should try to develop and improve on the use of existing local packaging. This may be achieved by new designs or through improvements in the handling system. .

Wooden boxes and trays widely used throughout the world. They are strong, rigid and can be manufactured locally as well as recycled. They can also stand refrigeration. However:

- Wood is often not available or is very expensive
- Boxes are not designed properly, resulting in poor stacking and ventilation characteristics, or,
- In an effort to save wood the boxes are too deep resulting in damage to the bottom layers of produce

Improved design is particularly likely to result in both savings in wood and reduced crop damage. The European produce tray has been successfully introduced in a number of countries. Critical design features of this tray include:

- Standard box sizes, particularly length and width, to facilitate stacking
- Using thin strips of wood for the floor and part of the sides but especially strong wood at the vertical corners, as these have to support the weight of the stack
- A gap between the sides of the tray, and the floor of the next tray, allowing for ventilation
- No lid but paper placed on top of the produce to reduce the effects of dust, evaporation and to minimise pilfering

Shallow trays are used for easily bruised crops such as tomatoes, peaches and grapes. Deeper boxes are used for apples. Larger but flimsier boxes are often used for cabbages and cauliflowers. In these developments the grower needs to work closely with the local box manufacturers. Again, pricing of packaging per kg of produce needs to be compared with that of existing packaging and should be tested before commercial introduction.

Fibreboard or corrugated cardboard are increasingly used. There are a number of very cleverly designed boxes that can be copied. The boxes are light and easily printed and can be made to look attractive. However:

- They are expensive and cannot be recycled
- They need to be waxed if they are to withstand long term storage
- They need to be manufactured by large factories

- The raw materials often have to be imported

Recent design improvements include boxes that are made from a combination of wood, for structural strength, and cardboard. Plastic has also been incorporated in designs, particularly to increase strength at the corners.

Plastic containers are expensive and generally have to be recycled and are mainly used as field boxes or to supply a regular outlet such as a factory or supermarket. Some polystyrene packaging is now being used for non-recyclable containers.

Bags and nets are cheap but provide no protection from damage. They can be used to package suitable produce like onions and potatoes into conventional units for handling and marketing.

Plastic and paper is often used as lining or wrapping for produce.

Modified atmosphere packaging can be used to extend the shelf life of many fruit and vegetables. This technology uses permeable films and the respiration rate of the product at a specific temperature to change the concentration of carbon dioxide and oxygen around the product. The use of polyethylene films significantly reduces water loss, retains organic acids, reduces physiological disorders, and extends storage life.

The main aim of modified atmosphere packaging (MAP) is to change the composition of the atmosphere around the product so that the storage life of the product can be extended. Most fruit and vegetables age less quickly when the level of oxygen in the atmosphere surrounding them is reduced. This is because the reduced oxygen slows down the respiration and metabolic rate of the products and therefore slows down the natural aging process.

Raising the level of carbon dioxide to levels of 2 % or more can also be beneficial. Elevated CO_2 levels can reduce the products sensitivity to ethylene; it can also slow the loss of chlorophyll i.e. the green colour of fruit and vegetables. High CO_2 can also slow the growth of many of the post harvest fungi that cause rots. All these effects can help to extend the storage and shelf life of fresh produce.

When a given weight of produce is sealed within a plastic bag, it uses oxygen and produces carbon dioxide. As the oxygen concentration inside the package falls, below about 10% the rate of respiration (oxygen use) starts to decrease. At the same time, oxygen moves into the bag through the walls of the plastic bag and carbon dioxide moves out. Oxygen and carbon dioxide move across the film in proportion to the drop in concentration of oxygen and rise of carbon dioxide concentration inside the plastic bag. This seems simple however the rate of oxygen consumed is dependent on the following factors;

- The weight of the product in the bag
- The temperature
- The respiration rate of the commodity. Respiration rate may vary among cultivars, seasons and growing conditions.

The difficulty with using modified atmosphere packaging is the establishment of a stable atmosphere inside the plastic bag. MAP is a dynamic system that is not controlled. If the oxygen level falls too low then anaerobic respiration can be initiated. If this happens alcoholic off-flavours develop within the product, making it unmarketable. For example, if the respiration rate increases as a result of a small change in temperature then the oxygen level will fall below the critical level and off-flavours will be produced. The same is true for atmospheres where the main benefit is high carbon dioxide. If respiration increases due to an increase in temperature then the level of CO2 may rise above the critical level and the product will also be damaged and made unsaleable. There are two ways to minimise the risk of spoilage. Firstly the use a package that provides slightly more oxygen, and so provides less benefit in terms of shelf life but the package would also have a reduced risk of spoilage. Secondly ensure that the temperature is maintained stable.

***TABLE:* Examples of products that benefit from modified atmosphere storage**

Product	Temperature °C	Oxygen(%)	CO2 (%)	Storage life in air (days)	Storage life in MAP(days)
Apple	0 - 2	1.5 – 2.5	1 - 5	120	180
Avocado	5 - 13	2 - 5	3 -10	42	84
Banana	13 - 16	2 - 5	2 - 5	28	49
Bean, snap	4 - 8	2 - 3	4 - 7	7	14
Broccoli	0 - 1	1 - 3	5 - 15	28	56
Lettuce	0 - 1	2 - 5	< 1%	21	28
Pear	- 1 -1	2 - 3	0 - 1	90	180
Pepper	7 - 12	2 - 5	2 - 5	21	28
Strawberry	- 0.5 - 0	5 - 10	15 - 20	14	21

The issue of handling the packing and packaging materials after their use is of great environmental and economic importance. Wooden crates are cheaper to manufacture and rigid, however they cannot be recycled and their return raises costs. Styrofoam and plastic boxes are lighter and of low cost, but have the disadvantage of disposal, since they cannot be recycled. Corrugated fibreboard is the most popular rigid container. If it is not treated with wax to give it water resistance, it can be recycled. There is also no need to be returned, so additional costs do not occur. Non-rigid containers are usually made of plastic film and some of have difficulties in recycling.

There is increasing pressure to create a more environmentally friendly means of handling packaging waste. Some EU governments have already enacted legislation regarding packaging and packaging waste. Their common objectives include the minimisation of waste, re-use by re-cycling and safe disposal where no other use is possible. Recycling legislation has implications for exporters of fruit and vegetables. The following general points should apply to recyclable packaging materials:

Paper and cardboard - should be free of any substances which would make them unsuitable for the paper production process such as bitumen, wax, oil, adhesives, impregnating agents or coatings.

Wood and wooden pallets - only solid wood and untreated chip board without coatings, paint or lamination or similar is acceptable. No plastic material should be attached, or metal parts that are more than 1 centimetre in diameter.

Foil/film - Only PE and PP foils without print, coating, adhesive and tape (excepting those which are of the same material as the foil) are acceptable. Bags should have no other material attached or be in any way contaminated.

Polyurethane foams and expanded polystyrene must be white, clean, without adhesives or smell and be separated into formed parts and loose chips. Foam containing CFC is not acceptable.

Grading, packing and packaging are important in adding value to a product and in many markets enable better prices to be obtained. However operations need to be designed carefully and efficiently, in order to minimise costs and ensure the additional prices obtained are sufficient to cover them and to minimise produce losses. Packaging can be the single most expensive cost, particularly with non-returnable containers made of wood or cardboard. The benefits must be shown to justify the investment. In the next example, where €3,000 is invested in packaging for 6,000 kgs of cucumbers worth €14,850, the costs can be said to be worthwhile if:

- An average of over €0.5 per kilo would be lost if the crop were not packaged
- Wastage would exceed 20%

Cost-benefit analysis of packaging

Net income with packaging for sales of 6,000 kg of produce	€14 850
Less cost of packaging (0.5 €/kg)	€3 000
Income to obtain the same return without packaging	€11 850
Therefore: Average sales price can fall to1.975 €/kg, i.e. by 0.5€/kg Or: 1,212 kgs can be wasted, a factor of 20%	

In practice the situation is usually more complex. Without packaging both wastage and damage levels will increase. The question is whether the cost of reducing losses results in a lower or greater profit for the grower.

Sometimes instead of crates, a cheaper but possibly more cost effective method for packaging and transporting may be tried. For example, for loose produce e.g. melons, it may be possible to introduce a combination of sacks and straw cushioning in the truck together with shelving. This will again affect not only the quality and quantity of produce sold but also the transport costs.

When attempting to introduce new types of packaging the growers first task is to compare its cost with the existing system of packaging. Subsequently they should monitor trial shipments and then carry out a cost/benefit analysis using actual, rather than theoretical, figures. The key is to select cost-effective packaging that is appropriate to the demands of the market.

CASE STUDY

Kourtllaris Imports-Exports Packhouse – Cyprus

Imports-Exports is a small packhouse in the area of Ergates in Cyprus. It was formed in 1989 by a single trader experienced in fruit and vegetables buying and selling. Establishing the pack house was a risk largely because it was not clearly known whether there would be sufficient buyers interested in buying sorted and cleaned production. However following simple market research it soon became clear the market (particularly export market) demand was growing. It soon became necessary to work for long hours, even during the night during the main season and many other factors were still outside the control of the pack house, such as bad weather conditions, air transportation space, poor production and high costs of transport,

Today, the pack house covers an area of 1500 square meters. It comprises of a main building where there are the offices, a lounge, a small kitchen, two toilets and an auxiliary room. The main construction is basically a large storehouse with concrete floors, a slope for drainage. On one side of the main building there is the delivery dock, which is elevated to fit the actual height of the trucks that deliver the produce to the pack house. On the other side of the building the cooling chambers and the uploading pier is situated. Inside the main building, there is the packing line and a storage place for the packing materials. The rest of the area is free. The business also owns three refrigerated trucks for the transportation of the packed goods to the airport.

The pack house employs 40 workers and including the two managers, plus clerical staff, and workers of the packing line. Most of the packing process takes place manually. The product is delivered at the dock in plastic containers and is weighed. Then it is transferred to a washing tank, where it is thoroughly washed. It is then placed on trays 5 x 2 meter on wheels, with a surface made of stainless steel netting for drying. When the excess water is removed, the trays are pushed next to the packing line. The packing line is a simple surface of rolling bars that allow the boxes to glide easily. Workers stand next to each other and fill the boxes with the appropriate number of bunches of leafy vegetables, or the appropriate number of kilos of fruit. A simple form of grading takes place as vegetables that do not fulfil the minimum specifications required are dumped. At the end of the packing line a worker closes the box and stacks it up on a pallet. When the pallet is complete, forklift vehicle carry it to a cooling chamber. When the order is ready to be dispatched, it is loaded on the refrigerated trucks and is transferred to the airport.

The pack house is working throughout the year. During the winter months it packs green leafy vegetables and in the summer it packs bell peppers, chilli peppers, zucchinis, beans, eggplants, okras and other vegetables according to the demand. The produce is gathered from all the agricultural areas of Cyprus.

The main packing material used is a white carton box, with dimensions of 20 x 30 x 60 cm. The box has two holes on each side, about 5 cm diameter for ventilation. The label has the name and the address of the pack house, the species and the variety of the product, the quality specifications and the place of origin of the product. Each box contains around 20 bunches of leafy vegetables, or around 5-10 kilos of weighted products.

The destination of the produce is mainly countries of the European Union, including, the UK, Norway, France, Germany.

1. What do you think are the strengths of the pack house in its current form?
2. Which are the main weaknesses that the business is faced with?
3. What are the main opportunities that you see arising for the pack house?
4. Identify the main threats confronting the pack house business.
5. Suggest a series of new equipment that could be helpful for the upgrade of the pack house.
6. How might electronic data collection systems have helped with market research when preparing the initial feasibility study?